BENEFIT FROM MOBILE HARBOR CRANES WITH EXTERNAL POWER SUPPLY

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KONECRANES
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EXTERNAL POWER SUPPLY – A KEY TOPIC

- No international standards impose onshore power supply (OPS)
- EU policy, e.g.
  - “Recommendation” of OPS to ports
  - OPS energy tax reduction
  - Directive: OPS mandatory in 2025
- US policy, e.g.
  - Reduction of onboard power generation
  - Fuel quality requirements
- National states set standards
  - Public pressure
  - (Low) distances to local communities require action
- Environmental responsibility is becoming a USP
- Ports emission statements
  - Use of OPS mandatory for operators
  - Incentives to shipping lines
EXTERNAL POWER SUPPLY – A KEY TOPIC

- Growing commitment to reduction of exhaust and noise emissions in terminals
- Trend towards electrification of handling equipment
- Many ports already have power main installations, others are working on it
- Various (voltage) solutions depending on terminal size and local conditions
STATUS QUO

Ships
• Environmental impact of moored vessels has been recognized
• More and more efforts on onshore power supply (“cold ironing”)

Stationary equipment (STS, yard cranes)
• Terminal mains supply of STS and RMG is common practice
• Electrification of RTG is ongoing (E-RTG)

Mobile equipment (lift trucks, straddle carriers, AGV)
• Other strategies are explored (e.g. battery drives)
THE MOBILE HARBOR CRANE – A SPECIAL CASE

Characteristics
• Self-contained (independent)
• Self-propelled (on-board power supply)
• Rubber-tired
• Multi-purpose

Key Advantages
• Flexible
• Any kind of cargo, any kind of port
• Mobile within the terminal
• Quays with and without infrastructure
ADVANTAGES COMBINED – FLEXIBILITY AND ECO-COMPATIBILITY

Konecranes Gottwald Mobile Harbor Crane

On-shore power supply
KONECRANES GOTTWALD
DIESEL-ELECTRIC DRIVE TECHNOLOGY

- Highly effective diesel-generator sets for on-board power supply
- Ultracaps for short time energy storage (hybrid)
- Recuperation of braking and lowering energy
- Ideal match for connection to harbor mains (diesel-generator bypassed)
KONECRANES GOTTWALD
DIESEL-ELECTRIC DRIVE TECHNOLOGY

Diesel generator
Ancillary consumers
Energy storage
Hoist
Slewing gear
Luffing gear

Engine
Generator
Ancillary consumers
AC
DC
Ultracaps
DC
AC
Electric motor
Slew.
Electric pump
Luff.

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ELECTRIC DRIVE SOLUTION

- ... has an excellent efficiency factor for significant fuel/operational cost savings
- ... harmonizes with ultracap-based hybrid technology
- ... is highly environmentally compatible
- ... is an ideal match to shore power
BENEFITS OF MHC WITH EXTERNAL POWER SUPPLY

• Increases efficiency
• Minimizes noise emissions
• No exhaust emissions in the port
• Lowers operating costs
• Reduces maintenance cost
DIESEL GENERATOR VS. HARBOR MAINS
EXAMPLE: HOIST DRIVE EFFICIENCY

- Under harbor mains, generator $\eta$ is of no consequence
- Efficiency $\eta$ increases still further

### Diesel generator

- **Generator** $95.0$
- **Controls** $99.0$
- **Hoist motor** $95.0$
- **Gears** $97.0$
- **Rope & hoist drum** $96.5$

\[ \eta = 0.95 \times 0.99 \times 0.95 \times 0.97 \times 0.965 \times 100\% = 84\% \]

### Harbour mains

- **Controls** $99.0$
- **Hoist motor** $95.0$
- **Gears** $97.0$
- **Rope & hoist drum** $96.5$

\[ \eta = 0.99 \times 0.95 \times 0.97 \times 0.965 \times 100\% = 88\% \]

Hoist drive efficiency: $84\%$

Hoist drive efficiency: $88\%$
ECO-EFFICIENT SOLUTION

Eco...nomical benefits

• Greater flexibility – free travel of the crane with on-board power and eco-efficient handling operation with external power

• Increased drive efficiency

• Electricity is recuperated and reused; feedback into terminal grid

• Lower energy consumption – lower operating costs

• Longer service intervals and lifetime – reduced maintenance costs

Eco...logical benefits

• No local exhaust emissions

• Reduced noise emissions

• Natural resource savings

• Significantly improved environmental footprint
MEDIUM VOLTAGE

- Motor-driven cable reel with one cable
- Power cable duct
- Underground quay switch cabinet
- Transformer
- Alternative: quay power socket
- Power cable deflection funnel
LOW VOLTAGE

Motor-driven cable reel with two cables
Quay switch cabinet
Power plug-in contacts
Transformer
Power cable deflection funnel
2 x 690 V power cable
PREPARED FOR RETROFIT OF EXTERNAL POWER SUPPLY

Preparation includes

- Mains/generator changeover switch
- Slip ring body with power set
- Switch cabinet at chassis
KONECRANES ELECTRIC DRIVE SOLUTIONS

1. Optimized diesel genset on crane
2. Diesel genset + 2nd energy source => hybrid
3. Grid solution: shore power
4. All in one: genset, hybrid and shore power

Ultracaps: electrostatic short-term energy storage media

Surplus energy from the crane is fed back to the grid
CONCLUSION

• More and more ports are taking proactive measures to reduce emissions

• Shore power supply for equipment and ships is key in this context

• The mobile harbor crane is a special case on the equipment side

• Konecranes Mobile Harbor Cranes can combine flexibility of free travel with benefits of on-shore power supply in a particularly eco-efficient way thanks to their electric drive concept

• Shore power and electric drive system are an ideal match
NOT JUST LIFTING THINGS, BUT ENTIRE BUSINESSES